

What Is Claimed Is:

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1. An information recording apparatus in which in an information recording apparatus for recording main data by forming a pit row or a mark row to an information recording medium by irradiating the information recording medium with a beam for recording, said information recording apparatus comprising:

first modulating signal generating means for generating a first modulating signal in correspondence with the pit row or the mark row;

second modulating means for generating a second modulating signal by modulating the first modulating signal by sub-data such that a pit or a mark of the pit row or the mark row is locally changed in accordance with a logical level of the sub-data; and

beam modulating means for modulating the beam for recording by the second modulating signal;

wherein the second modulating means generates the second modulating signal by allocating one bit of the sub-data to the pit row or the mark row having a predetermined length or more with regard to a defect having a size by which at least the main data can correctly be reproduced such that the main data can correctly be reproduced.

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2. The information recording apparatus according to Claim 1, wherein the predetermined length is a length of 1 [mm] or more.

3. The information recording apparatus according to Claim 1, wherein the predetermined length is a length by which the defect can be detected by optical observation in the case in which there causes a defect for making the one bit of the sub-data difficult to reproduce.

4. The information recording apparatus according to Claim 1, wherein the second modulating means comprising:

binary coefficient row generating means for generating a binary coefficient row with the first modulating signal as a reference;

disturbing means for generating a disturbing signal by disturbing the sub-data by the binary coefficient row; and

signal modulating means for generating the second modulating signal by modulating the first modulating signal by the disturbing signal.

5. The information recording apparatus according to Claim 4, wherein the binary coefficient row is a binary coefficient row of M series.

6. The information recording apparatus according to Claim 4, wherein the binary coefficient row generating means

generates at least a first and a second one of the binary coefficient rows, the disturbing means generates a first and a second one of the disturbing signals by disturbing a first and a second one of the bit rows by the sub-data respectively by the first and the second binary coefficient rows and generates the disturbing signal by multiplexing the first and the second ones of disturbing signals.

7. The information recording apparatus according to Claim 6, wherein the disturbing signal is generated by multiplexing the first and the second ones of the disturbing signals by selecting the first and the second ones of the disturbing signals in accordance with a predetermined random number.

8. The information recording apparatus according to Claim 4, wherein binary coefficient row generating means initializes the binary coefficient row at a constant period with the first modulating signal as a reference.

9. The information recording apparatus according to Claim 1, wherein the first modulating means generates the first modulating signal by ciphering the main data and the sub-data is data necessary for deciphering the main data.

10. An information recording method, wherein in an information recording method for recording main data by forming

a pit row or a mark row on an information recording medium by irradiating the information recording medium with a beam for recording, said information recording method comprising:

a step of generating a second modulating signal by modulating a first modulating signal in correspondence with a pit row or a mark row by sub-data in accordance with a logical level of the sub-data such that a pit or a mark of the pit row or the mark row is locally changed; and

a step of modulating the beam for recording by the second modulating signal and irradiating the information recording medium with the modulated beam for recording,

wherein the second modulating signal is generated by allocating one bit of the sub-data to the pit row or the mark row having a predetermined length or more with regard to a defect having a size by which at least the main data can be reproduced correctly such that the sub-data can be reproduced correctly.

11. An information recording medium, wherein in an information recording medium recorded with main data by a pit row or a mark row, sub-data is recorded by a local change of a pit or a mark of the pit row or the mark row and one bit of the sub-data is allocated to the bit row or the mark row having a predetermined length with regard to a defect having

a length by which the main data can be reproduced correctly such that the sub-data can be correctly reproduced.

12. The information recording medium according to Claim 11, wherein the predetermined length is a length of 1 [mm] or more.

13. The information recording medium according to Claim 11, wherein the predetermined length is a length by which in the case in which a defect which makes the one bit of the sub-data difficult to reproduce is caused, the defect can be detected by optical observation.

14. The information recording medium according to Claim 11, wherein the local change is formed in accordance with a disturbing signal disturbing the sub-data by a binary coefficient row.

15. The information recording medium according to Claim 14, wherein the binary coefficient row is a binary coefficient row of M series.

16. The information recording medium according to Claim 14, wherein the binary coefficient row comprises at least a first and a second one of the binary coefficient rows and the disturbing signal is generated by multiplexing a first and a second one of the disturbing signals generated by disturbing a first and a second one of the pit rows by the

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sub-data by the first and the second ones of binary coefficient rows.

17. The information recording medium according to Claim 16, wherein the first and the second ones of disturbing signals are selected in accordance with a predetermined random number to thereby generate the disturbing signal.

18. The information recording medium according to Claim 14, wherein the binary coefficient row is initialized at a constant period with the pit row or the mark row as a reference.

19. The information recording medium according to Claim 11, wherein the main data is ciphered and recorded and the sub-data is data necessary for deciphering the main data.

20. An information reproducing apparatus, wherein in an information reproducing apparatus for irradiating an information recording medium recorded with main data by a pit row or a mark row with laser beam and receiving return beam to thereby reproduce the main data, said information reproducing apparatus comprising:

reproduced signal generating means for receiving the return beam and generating a reproduced signal a signal level of which is changed in accordance with the pit row or the mark row;

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main decoding means for decoding the main data by dual-identifying the reproduced signal;

sampling means for sampling the reproduced signal and outputting a sampling signal; and

sub decoding means for reproducing sub-data recorded by a local change in a pit or a mark of the pit row or the mark row by repeating to integrate the sampling signal for a predetermined time period;

wherein the sub decoding means is set with an integrating time period in correspondence with one bit of the sub-data as a time period by which with regard to a defect having a size by which at least the main data can correctly be reproduced, the sub-data can be decoded correctly.

21. The information reproducing apparatus according to Claim 20, wherein the integrating time period in correspondence with the one bit of the sub-data is a time period in correspondence with a length of 1 [mm] or more of the pit row or the mark row.

22. The information reproducing apparatus according to Claim 20, wherein the integrating time period in correspondence with the one bit of the sub-data is a time period by which in the case in which a defect which makes the one bit of the sub-data difficult to reproduce is caused, the defect

corresponds to a length which can be detected by optical observation.

23. The information reproducing apparatus according to Claim 20, further comprising:

binary coefficient row generating means for generating a binary coefficient row with the reproduced signal as a reference;

wherein the sub decoding means integrates the sampling signal in accordance with the binary coefficient row.

24. The information recording apparatus according to Claim 23, wherein the binary coefficient row is a binary coefficient row of M series.

25. The information reproducing apparatus according to Claim 23, wherein the binary coefficient row generating means generates at least a first and a second one of the binary coefficient rows and the sub decoding means decodes the sub-data by a first and a second one of the bit rows in correspondence with the first and the second ones of the binary coefficient rows by integrating the sampling signal respectively in accordance with the first and the second ones of the binary coefficient rows.

26. The information recording apparatus according to Claim 23, wherein the binary coefficient row generating means



initializes the binary coefficient row at a constant period with the reproduced signal as a reference.

27. The information reproducing apparatus according to Claim 20, wherein the main decoding means deciphers the main data based on the sub-data.

28. An information reproducing method, wherein in an information reproducing method for irradiating an information recording medium recorded with main data by a pit row or a mark row with laser beam and receiving return beam to thereby reproduce the main data, said information reproducing method comprising:

a step of decoding the main data by dual-identifying a reproduced signal a signal level of which is changed in accordance with the pit row or the mark row provided by receiving the return beam; and

a step of reproducing sub-data recorded by a local change in a pit or a mark of the pit row or the mark row by repeating to integrate a sampling signal provided by sampling the reproduced signal for a predetermined time period;

wherein an integrating time period in correspondence with one bit of the sub-data is set to a time period by which with regard to a defect having a size by which at least the main data can be reproduced correctly, the sub-data can

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correctly be reproduced.

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